PRESERVATION OF SURVEY LINES AND POINTS IN MINES.

BY H. V. VAN ATTA.

There are probably few persons present who are not connected, either directly or indirectly, with the working of some coal mine in the State of Ohio; and you who have made surveys in the coal mine, know how tedious and laborious it is to "pick up" the line of a former survey, if it was not properly preserved when made. And you who are having surveys made, know something about the expense and time required in locating entries or rooms in reference to the surface of the land, and how often the work has to be done over and over from the failure to properly preserve the line in the beginning, thereby costing much time and labor to do a small amount of work. Whereas if the engineer would spend a little more time, in making the first survey, putting good points inside and on the surface and preserving his notes, he would always be ready when information was wanted.

If the work required is within the limits of the last survey, he could go to the place and by starting off of his former line could give the required information in a short time. If, however, it is beyond the limits of his former work, he could begin where he left off and work his way ahead without loss of time. Hence the importance and necessity of the "preservation of survey lines and points in mines."

The object of this paper is to illustrate the method of preserving surveys, as practiced in those mines of the Hocking Valley, of which Mr. Jennings is Chief Engineer.

In the Hocking Valley there are some advantages over other coal fields of the State, and one of the greatest is, nearly all entries can be driven either on the "faces or butts" of the coal, or in any direction most facilitating the economic working of the coal. Some times they are driven paralled to a property line.

The first thing in starting a coal mine, after the territory has been selected, is to decide upon the points to open the first entries in accordance with your wishes as to their direction. This having been determined, the engineer sets stakes for the center line of the entry. If the mine is a "level free," one stake should be set level with the bottom of the coal, then farther up the hillsides two or three more should be set about 10 or 15 feet apart, thus enabling the workman to make a suitable excavation for placing the timber, which form the mouth of the mine. The entry line is then preserved by driving two or more good solid stakes down level with the ground in places where they will be the least liable to be disturbed. These stakes are generally set, one on

each side of the hollow, in which the mine is located, and close to either a tree or rock or in a fence corner, then a four-penny nail is driven in the top of each stake to indicate the exact spot where the entry line falls.

When the timbers, at the mouth of the mine, have been set solidly in their proper places and planked over, the entry line is transferred to them from the hillside, by putting points in the underside of two of the caps.

The points just spoken of are made of sheet brass 1-16 inch thick, triangular in shape, $\frac{3}{8}$ inch wide at the base and $1\frac{1}{2}$ inches long with a $\frac{1}{4}$ inch hole far enough back from the base, so that it will not be injured when driving the nail.

The reason for using brass nails is that the corrosive effect of the smoke and damp atmosphere of the mine is less on brass than on iron. These nails are driven in the timbers, the hole being the center line of the entry. From these nails plummets are now suspended and the miner sighting by the strings can direct the placing of a lump on the center line at the face of the entry.

After the points have been put in the timbers, the next step is to connect the entry line with the outside survey, which is done by intersecting the entry line with the center line of the railroad, taking the station on the railroad, the angle formed, and the distance from the intersection to the first nail in the mouth of the mine, which is always put in the first timber and called 0 of the future mine survey. In addition to the railroad connection, the entry line is connected with a prominent land line which has been established.

As the work in the mine progresses the timbers are left behind and the entry has a coal, slate or perchance a sand rock roof and when driven 200 or 300 feet ahead of the points, it is necessary to set point nearer the face. To do this a plumb-bob is suspended from station 0 and a point placed beneath it on the floor of the entry. The point used is a round head tack in the center of a cast-iron plate six inches square and one inch thick. The transit now set over the point, a backsight taken on the hub outside, the telescope reversed and line given for points at the face of the entry.

As there are no timbers at the face of the entry in which to drive the brass nails, and as they would surely get loose and finally fall out if driven in the roof, something must be done to supply the place of the timbers; to do this, two holes are drilled in the roof, five inches deep, on the center line and about four feet apart, into which are driven wooden plugs. The nails are now set on line and driven into the plugs and the station taken to them. Thus the line is completely transferred to the inside of the mine. When the entries need pointing again, the transit is set under one of the nails last put in and the points moved ahead as before.

All rooms are started off the entries at regular distances from each other and points are put in the necks of all. The station is taken from the entry line to the second nail, so that the rooms can be measured at the end of each month without the aid of the transit. In meas-

uring rooms plummets are suspended from the nails and line given at the face; the station from the second nail to the face plus the distance from the entry line to the second nail.

The object of pointing rooms is the same as pointing entries, and with little care the miner can keep his room straight and always have the required amount of pillar between himself and neighbor.

In pointing rooms common 8-penny steel fence nails are used, which are preferable to iron, because if the nail slips to one side while being driven, it can be bent to bring the center of the head on line without breaking. Thus it continues through the entire mine as the work progresses.

All notes of one mine are put in a book kept purposely for that individual mine. The notes are taken in pencil and afterwards traced over with India ink and thereby preserved.

The system here described is the result of a six years' experience with the difficulties of mine surveying.

Previous to this time our work was all surface work, where the practice is to put wooden plugs in the ground and when the mine work was begun, I attempted to follow the same system under ground. Instead of using wooden plugs I used plugs made ¾ inch round iron, 8 or 10 inches long, which were driven in the floor of the entry and a center dot made in the top for the exact line. But I soon found that the action of the sulphur in the coal, along with dampness and other causes would very quickly corrode the iron plug so that the dots could not be found and oftentimes the plug would be entirely destroyed with rust; and when I would go to do work in the mine I had to spend a great deal of time in hunting for the plugs and when found I never would feel confident that they were just as I left them. The idea then presented itself that the proper place for preserving the line is the roof and not the floor.

The plan next adopted was driving common iron fence nails in the roof. This plan worked well while the entry was new and the the roof remained firm. But after the exposure to the action of the air the roof would begin to scale off, which would loosen the nails and cause them to fall out; and even if they remained in the roof, they would sometimes get knocked off of line by being struck with picks, drills or bank timbers which were being taken into the mine.

Although this plan had many advantages over the former one, the frequent loss of the nails from the causes just enumerated, as well as the impossibility of driving nails in the rock, which is occasionally encountered in the mines of the Hocking Valley, made it necessary to adopt some other plan.

The idea then suggested itself of drilling holes and putting wooden plugs in the roof and driving into these horse-shoe nails, the heads of which had been flattened and a hole punched in their centers.

The first drilling apparatus was a common brace drill, turned by hand and held to the roof by using a bank rail for a lever and a three-legged trestle for a fulcrum. This answered the purpose very well, but the difficulty of always having a lever and fulcrum at the place needed, made it desirable that such a drill be devised so that the lever and fulcrum could be dis-

pensed with. I therefore decided on a plan and made a self-feeding drill, which I have on exhibition at this meeting.

The brace of the drill is made of ¾ inch round steel, 6 inches clearance and 6 inches swing. To the upper end of the brace is welded a piece of ¾ inch gas pipe, which is two feet long and has a collar and set screw on its upper end. Into the hole of the gas pipe is fitted a rod of round iron, which is a little longer than the gas pipe, and has had one end enlarged and fitted with a ½ inch square socket hole in the end to receive the square shank of the drill bit. This rod is held at any desired height by the set screw in the upper end of the gas pipe. The lower end of the brace is centered and onto it is welded a piece of ¾ inch gas pipe about 4 inches long, which is calculated to fit over a 4 inch pivot end of a screw 12 inches long; of this screw the upper 5 inches is blank and the lower 7 is a screw of ten threads to the inch, and is fitted into a long nut on the upper end of which is a collar ½ inch larger than the nut. At lower part of blank end of screw is a small wheel by which the drill is fed when the screw feed is too heavy. When the brace is set down over the pivot end of the screw a pin is inserted in a hole which runs through the lower piece of gas pipe and the pivot point of the screw, thus making it a self-feeding drill; and when it is necessary to feed by hand this pin is removed and the drill fed by turning the little wheel. The lower part of the long nut is inserted in the hole in the top of a common tripod, the legs of which have been shortened. A dowell-pin in the top of the tripod engages with a like pin in the collar on the long nut and thereby keeps the nut from turning when the drill is being used. The drill bits are made of steel; are 6 inches long and drills a ¾ inch hole.

DISCUSSION.

MR. CHAMBERLAIN—I have been very much interested in the paper to which we have been listening, and very much gratified to have the opportunity of examining the machine which Mr. VanAtta has illustrated his remarks.

A vote of thanks was tendered Mr. VanAtta for his very interesting paper.